

REMARKS

INTRODUCTION

Claims 1-26 were previously pending and under consideration.

Claims 27-32 are added herein.

Therefore, claims 1-32 are now pending and under consideration.

Claims 1-22 are rejected.

Claims 1, 8-10, 12, 19-21 and 23 are amended herein.

No new matter is being presented, and approval and entry are respectfully requested.

ENTRY OF AMENDMENT UNDER 37 CFR §1.116

Applicant requests entry of this Rule 116 Response because:

- (a) the rejected claims have been canceled;
- (b) it is believed that the amendment of the claims puts this application into condition for allowance as suggested by the Examiner;
- (c) the amendments were not earlier presented because the Applicant believed in good faith that the cited prior art did not disclose the present invention as previously claimed;
- (d) the amendments of the claims should not entail any further search by the Examiner since no new features are being added or no new issues are being raised; and
- (e) the amendments do not significantly alter the scope of the claims and place the application at least into a better form for purposes of appeal. No new features or new issues are being raised.

The Manual of Patent Examining Procedures sets forth in Section 714.12 that "any amendment that would place the case either in condition for allowance or in better form for appeal may be entered." Moreover, Section 714.13 sets forth that "the Proposed Amendment should be given sufficient consideration to determine whether the claims are in condition for allowance and/or whether the issues on appeal are simplified." The Manual of Patent Examining Procedures further articulates that the reason for any non-entry should be explained expressly in the Advisory Action.

TRAVERSAL OF RESTRICTION

Claims 23-26 were restricted and constructively elected as being directed to a separate invention. The restriction is traversed and withdrawal of the restriction and consideration of the claims is respectfully requested.

The restriction is traversed because group II is not properly placed in class 382, subclass 154, but rather belongs with group I in subclass 153. The Manual of Patent Classification describes subclass 154 as "[s]ubject matter wherein a three-dimensional scene is imaged using at least two cameras or camera locations for the generation of XYZ coordinate data of any object within the scene". In sum, subclass 154 is for virtual scene generation. Nothing in any of claims 23-26 suggests that XYZ coordinate data of any object in a scene can be determined. Claim 23, for example, recites determining an arrangement of an object relative to a robot. Group II properly belongs in the same class as group I; subclass 153. Subclass 153 is directed to "[s]ubject matter related to ... positioning articles by automated manufacturing systems using image analysis". Claim 23 recites "[a] method for automatically determining an arrangement of a workpiece relative to a robot", which is very similar to claim 1's "robot system having an image processing function for determining orientation, or orientation and position of a robot operation on an object of detection among a plurality of objects". Both claims 1 and 23 recite image matching, which is a well-known type of image analysis. Applicant respectfully requests an explanation of what features would enable generation of coordinates of any object in an imaged scene, and how claim 23 differs from claim 1 such that it belongs in a subclass other than subclass 153.

The restriction is also traversed because the cited particulars of group II are either found in group I or have been deleted. The restriction noted that group I does not have an image device affixed to a robot arm. This feature has been cancelled from group II. The restriction proposed that group I does not "[store] images of an [sic] workpiece/object shaped like the workpiece in the reference image". However, claim 1 recites "storing reference models, each created based on an image of a reference object ... said reference object being the object of detection or having a shape substantially identical to that of the object of detection". The restriction also proposed that group I does not "[capture] a working image of the workpiece from a known arrangement of the robot". However, claim 1 recites "an image of the object of detection (captured by said first image capturing device)", and claim 7 recites "said robot situates said second image data capturing device to have said determined orientation [e.g. a known orientation] or to have said determined orientation and said

determined position with respect to the object, so that said second image data capturing device is directed to a characterizing portion of the object; and wherein said processor detects three-dimensional position and/or posture [e.g. arrangement] of the object based on three-dimensional position of said characterizing portion obtained by said second image capturing device".

The restriction also proposed that the subcombination has a separate utility of determining an arrangement of a person or other specific object or workpiece relative to an image capturing device. First, group II does not recite determining an arrangement relative to an image capturing device. Second, claim 1 recites "determin[ing] the orientation, or the orientation and position of the robot operation to be performed on the object of detection". Applicant respectfully requests how this utility of claim 1 differs from claim 23's "determining an arrangement of a workpiece relative to a robot"

Entry and consideration of claims 23-26 is respectfully requested.

Applicant respectfully notes that "[w]here the initial requirement is traversed, it should be reconsidered. If, upon reconsideration, the examiner is still of the opinion that restriction is proper, it should be repeated and made final in the next Office action. (See MPEP § 803.01.) In doing so, the examiner should reply to the reasons or arguments advanced by applicant in the traverse." MPEP § 821.01. Applicant respectfully requests a separate reply to each of the arguments presented above.

OBJECTIONS TO THE DRAWINGS

In the Office Action, at page 3, the proposed drawing correction was objected to. In view of the accompanying separate Attachment to the Amendment, corrections to Figures 6 and 9 have been requested. Therefore, the outstanding drawing objections should be resolved.

Reconsideration and withdrawal of the outstanding objections to the drawings are respectfully requested.

REJECTIONS UNDER 35 USC § 112, SECOND PARAGRAPH

In the Office Action, at page 6, claims 8-10 and 19-21 were rejected under 35 U.S.C. § 112, second paragraph, for the reasons set forth therein. Claims 8-10/19-21 are amended from their true original form in view of the Preliminary Amendment filed April 6, 2003 (i.e. dependence from claim 1/12) to now depend from claim 6/17. Withdrawal of the rejection is respectfully requested.

NEW DEPENDENT CLAIMS 27-32

For the convenience of the Examiner, it is noted that new dependent claims 27-29 are similar to claims 8-10, and new dependent claims 30-32 are similar to claims 19-21.

REJECTIONS UNDER 35 USC § 103

In the Office Action, at pages 6-9, claims 1-4 and 12-15 were rejected under 35 U.S.C. § 103 as obvious over Suzuki in view of Kelley. This rejection is traversed and reconsideration is requested.

PRIOR ART DOES NOT MATCH IMAGE OF OBJECT OF DETECTION WITH
PREDETERMINED REFERENCE MODELS BASED ON IMAGE OF REFERENCE OBJECT
CAPTURED IN PLURALITY OF DIFFERENT DIRECTIONS TO DETERMINE
ORIENTATION OF THE OBJECT OF DETECTION

Claim 1, for example, recites "determining orientation ... of a robot operation on an object of detection among a plurality of objects", by "storing reference models, each comprising an image of a reference object captured by said image capturing device in a different direction [and information of the same]", and by performing "matching processing on the reference model images and a working image of the plurality of objects (captured by said first image capturing device) to select an image of one of the reference models that matches the object of detection in the working image" whose reference model (having capture direction information) is then used to determine "the orientation of the robot operation to be performed on the object of detection". Claim 12 recites similar features with plural kinds of objects. See also claim 23.

The rejection cites Kelley as adding to Suzuki the matching of an image of a workpiece captured during operation to a reference model created during instruction. The

rejection cites Suzuki for the robotic acquisition of model images from different directions, and cites Kelley for matching reference models to an image of the workpiece to determine the workpiece's orientation relative to the robot. However, neither reference discusses or suggests using predetermined workpiece-robot arrangement information (reference models) to orient the robot for the purpose of acquiring or preparing to acquire the workpiece. In Kelley, the workpiece is picked up without knowing its orientation. In Suzuki, there is no indication that the orientation of the workpiece is known when it is picked up, or if it is known, how it is determined.

Neither Suzuki nor Kelley use predetermined workpiece-robot position/orientation information to orient the robot for picking up or preparing to pick up the workpiece. In Suzuki, there is little discussion of how the robot acquires a part on the conveyor belt. The position is determined by a CCD, but the orientation of the robot is not discussed. In Kelley, the part-robot relative arrangement is determined after the part has been picked up.

Suzuki discusses three-dimensional positions of the vertices and edges of the sample product 10, which is made up of a plurality of parts. The edge and vertex information is based on analysis of two-dimensional images obtained by imaging the sample product 10 from various directions by a pair of CCD cameras. The captured images are not used after deconstruction. Suzuki does not discuss or suggest performing matching process with an image of the object of detection using reference models that are predetermined based on images of a reference object captured in a plurality of different directions (thereby determining the orientation of the object of detection). Suzuki discusses capturing images from different directions to derive the construction of the parts. The robot orientations during capture are not used during operation of the robot. Construction operations are predetermined based on the derived construction. The parts are then sequentially presented on the conveyor. They are picked up by the robot, and the pickup position is determined by CCD. There is no discussion of whether or how the pickup orientation is determined. Kelley discusses determining a location of a pickup site on a workpiece.

Kelley does not discuss selecting one of the images of the reference models that matches an image of a plurality of objects, one of which is the object of detection, in the fashion discussed above. In contrast, Kelley discusses determining orientation of a workpiece held by a vacuum cap hand (28). Column 13, lines 35-53 of Kelley discuss "[f]ollowing successful acquisition of a workpiece from the hand, workpiece orientation in the robot hand is found... If the piece was not dropped, a binary image is formed using the

workstation camera (44) and the image features are computed. The features are matched to the feature models stored during instruction for each of the J hand-workpiece relationships." This process is performed to determine an orientation of the workpiece that is already held by the vacuum hand (28), and does not select or find an image of the workpiece that matches one of the reference models in a plurality of workpiece is randomly arranged in a container. In Kelley, solid regions (corresponding to workpiece services without holes or grooves) in the binary image obtained by the arm camera (42) and fun are subjected as candidate hold sites for holding a workpiece when being picked up from the been.

It is particularly notable that Kelley uses a vacuum cap hand. This is because the orientation of the workpiece before pickup is not known. The vacuum cap allows pickup regardless of the orientation.

Finally, the rejection's proposed motive to combine Kelley with Suzuki is incorrect. The rejection states that it would have been obvious to add Kelley's reference model matching in order to acquire a workpiece from randomly arranged workpieces without requiring complete knowledge of the position and orientation of a workpiece in a bin. However, in Suzuki, the workpieces are laid flat and arrive one at a time on a conveyor belt in the order needed for construction. Therefore, there is no need to apply Kelley's technique in Suzuki.

DEPENDENT CLAIMS

The dependent claims are deemed patentable due at least to their dependence from allowable independent claims. These claims are also patentable due to their recitation of independently distinguishing features. For example, claims 6, 7, 17, and 18 recites using a second image capture device from the orientation found using the reference models to further orient the robot. This feature is not taught or suggested by the prior art. Withdrawal of the rejection of the dependent claims is respectfully requested.

CONCLUSION

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,
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